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its ends *b b*; the plug *B* has also a similar piece of platina tube *c*, passed through and fixed within it: there is also a disc of platina *d*, fig. 5, fixed on two opposite sides of the plug *B*, at right angles to the tube *c*, which resists the action of the gas (when shut), that may be contained in any vessel to which it is attached.

Fig. 5 is an external view of the plug *B* (in the same position as in fig. 4), showing one of the discs *d*, of platina.

Fig. 6 is a view of the opposite side of the plug, showing the end of the platina tube *c*.

No. IV.

PLAN FOR CONSUMING THE SMOKE OF STEAM-BOILERS, &c.

The LARGE SILVER MEDAL of the Society was this session presented to Mr. G. CHAPMAN of Whitby, for his METHOD OF CONSUMING THE SMOKE OF STEAM-BOILER FURNACES, &c. The following communication on the subject has been received from the candidate.

SIR,

Whitby, February 4, 1824.

I BEG leave to offer myself as a candidate for the premium offered by the Society for the encouragement of Arts, Manufactures, and Commerce, entitled "a more effectual consumption of smoke in steam engines, breweries, &c."

It is well known to all that are conversant on the subject, that it is necessary to admit a proportion of pure atmospheric air, to unite with the smoke after it is generated in

the furnace, in order to supply the oxygen gas, without which it will not inflame. It is likewise known that any air admitted into the body of the furnace, if it does not go through the burning fuel, has a great tendency to cool the bottom of the boiler, and retard the generation of steam. To obviate this, it is the general practice, in the construction of those furnaces which consume the smoke, to admit the air partly at the ash-pit, and partly up through the fire-bridge. I offer for the consideration of the Society an improved plan, which I have adopted, and which has answered beyond my utmost expectations. It is as follows :

To heat the air before its admission into the furnace. This I do by casting the grate bars hollow from end to end, so that they form a series of parallel tubes, which open into two boxes, one placed in front, and the other behind the grate. In the front box, directly underneath the fire-door, I make a register to open and shut, to any extent, at pleasure. The other end I connect with the brick-work directly under the fire-bridge, which fire-bridge I make *double*, with a small interval between, say one inch; the interval to go across the furnace from side to side, and rather to incline forward, or towards the fire-door, so as to meet and reverberate the smoke on to the ignited fuel in the grate, which causes it to inflame and become a sheet of bright fire under the bottom of the boiler.

From what I have said you will perceive that if the front register is open, or partially so, there will be a great draught of air through it, along the interior of the grate bars, thence into the flue of the fire-bridge, and out of the orifice at top, which air will be heated in its passage through the bars, before it comes in contact with the smoke, when it will give out its oxygen, and cause it to inflame.

Such was my view of this part of the subject in theory, and I have found it to succeed in practice, in a small engine of my own. But a further improvement was necessary to make it quite perfect. There are few people who are aware of the extent of the mischief arising from the old method of charging a grate by the front door. Now, in my engine, (which is only two horse power), I calculated that every time the fire-door was opened to stir the fire and replenish the fuel, there could not be less than from forty-five to fifty cubic feet of cold atmospherical air admitted into the furnace, which so cooled the heated gases, &c. that, however complete the plan was in other respects, the smoke could not possibly inflame, from being so cooled, till a considerable time after the fire-door was shut.

To obviate this I have adopted a cast-iron hopper above the fire-door, with a type at the bottom that has two pivots at one side and opens at the other; one pivot goes through the end of the hopper and has a counter lever to keep the type shut when a sufficient quantity of coal for a charge is on it. The top of the hopper is covered with a lid which I shut down during the time of firing, then, by lifting the lever which opens the type inside, the coals slide down on to the fore end of the grate bars, which is only the work of a moment. It is evident that no quantity of cold air can thus get into the furnace; in fact, it is not possible for any person that does not see the operation of firing to know when fresh fuel is added by looking at the top of the chimney. The smoke that issues is never more than a light grey, just perceptible, but in a general way is not seen at all.

The coals last admitted, after lying a short time at the front of the more ignited fuel, become partially coked,

and just before I admit a fresh supply, I push the last charge further along the grate, by a tool made for the purpose, which remains constantly in the furnace. It consists of a plate of iron about four inches broad; its length goes across the grate with a round bar of iron rivetted into its centre, at right angles, to form a handle, which comes through a hole made in the bottom of the fire-door, and is long enough for a man to use with both hands, so that he can either push from, or pull towards him, to manage the fire within, without opening the fire-door, except when the grate wants cleaning, &c. &c. For better knowing when the fire wants stirring, or replenishing, I have a hole, about an inch in diameter, in the fire-door, to look through, covered by a piece of iron which hangs by a rivet above.

After I have used the above instrument I pull it up close to the fire-door, where it remains till it is again wanted; and the coals, when let into the fire, fall down beyond it.

The above-written account constitutes the whole of my improvements so far as is required by the Society, but not the whole of the advantages gained by my invention. For instance, the durability of the grate-bars by the admission of air through them. I may add, that I examined my own yesterday, and I do not find them any worse, although they have been in use since the beginning of October last. In conclusion, I beg leave to refer you to the accompanying certificates by gentlemen who have had an opportunity of personally viewing my improvement, and who, I flatter myself, are all people of the first respectability.

I am, Sir,

&c. &c. &c.

A. Aikin, Esq.

Secretary, &c. &c.

G. CHAPMAN.

N. B. I am perfectly aware that there are many plans of feeding furnaces by means of hoppers, yet I trust you will find my plan somewhat different; it is at least to what have fallen under my notice.

Reference to the figures of Mr. Chapman's mode of consuming the smoke of steam-boilers.—Plate II.

Fig. 1, An elevation.

Fig. 2, A section.

(The same letters refer to the same parts in both figures.)

a The boiler.

b The fire-place.

c The feeding-hopper, with its cover *d*, and its type, or turning bottom, with its lever and counterpoise *e*, by means of which the coals are delivered into the fire-place.

f A rake, by means of which the half-burnt coals are pushed forwards previously to letting in a fresh charge.

g A slit below the furnace-door, through which the shaft of the rake passes.

h An eye-hole in the furnace-door, through which the state of the fire is seen.

i i An air-tight box into the back of which the bars open, and in front of which is a register for the admission of air.

k One of the hollow bars, the whole of which are shown in fig. 3, as they open into the box *i*, fig. 1.

l A flue in the fire-bridge, through which the air, having passed first into the box *i*, and thence through the hollow bars *k*, passes into the furnace and consumes the smoke.

CERTIFICATES.

Whitby, January 30, 1824.

THIS is to certify that we, the undersigned, when first we knew that George Chapman was going to erect his steam-engine, &c. so near our houses, being from the furthest only forty yards, and from the nearest thirty yards, the engine chimney right in front of the door, were very much afraid, and apprehended a nuisance from the smoke, &c.; but since the engine has been set to work we are very agreeably disappointed, as we seldom see any smoke; the little we do see, we understand, is when the fire is new lighted.

Rev. Jos. ROBERTSON,
ROBERT WATSON, Gentleman.
GEORGE WATSON, Gentleman.

Sneaton Castle, Whitby,
January 30, 1824.

THIS is to certify that I have examined Mr. George Chapman's invention for the consumption of smoke arising from furnaces of steam engines, &c., and I find it answer every purpose preferable to any other that I have yet seen, and consider it worthy of the notice of the Society for the encouragement of Arts and Manufactures.

JAS. WILSON.

Whitby, January 30, 1824.

HAVING examined the apparatus invented by Mr. George Chapman of this place, to prevent the emission of dense smoke from the furnace of his steam-engine, and having seen it brought to the test of experiment, I am fully satisfied as to its success; and have no doubt, that were the same apparatus generally adopted, the smoke from such furnaces would no longer be a nuisance to the vicinity.

GEORGE YOUNG, A. M.

*Secretary to the Whitby Literary and
Philosophical Society.*

Whitby, January 30, 1824.

I BEG leave to state, that I have visited Mr. George Chapman's foundry, for the purpose of witnessing his improved method of consuming the smoke which is generated in furnaces. Mr. Chapman's plan, as he observed, seems to consist, principally, in admitting the atmospheric air necessary for combustion along the heated bars of the fire grate, which are cast hollow for that purpose. The air being heated in its passage, more readily gives out its oxygen, by which the generation of smoke is nearly prevented, and the process of combustion more accurately performed.

On the application of fresh fuel, the smoke which ascended from the chimney assumed the appearance of a light grey vapour, and in a few seconds became nearly invisible.

The superiority of Mr. Chapman's method was further evinced by opening the door of the furnace and allowing a quantity of cold atmospheric air to enter in the usual way; when this was done, the smoke rolled out of the chimney in black dense clouds, which effect ceased almost immediately on closing the door.

RICHARD MOORSOM, Jun.

No. V.

EAST INDIAN ANNATTO.

TOWARDS the conclusion of the session 1822-3 the Society received a communication from James M'Killop, Esq. King's Arms-yard, Coleman-street, consisting of a note from that gentleman, a letter from Cruttenden, M'Killop, and Co. of Calcutta, and a few cakes of East India annatto.

The Society had, during some preceding years, offered a premium to the person who should import from any part of British India a certain quantity of annatto, equal in value as a dyeing drug to that which is produced in several of the late Spanish American colonies, and which is brought into this country under the name of Spanish annatto.

It appears from the letter of Cruttenden, M'Killop, and Co. that Messrs. C. Stewart and Co. lac-dye manufacturers in the Bancoorah district, Bengal, had been preparing, with great care, a small quantity of annatto, for the purpose of being distributed among the silk dyers of London, in order